CLAIMS

1. The method for carrying out an electrosurgical cutting procedure at the subcutaneous situs of a target tissue volume of given size situate within healthy tissue, comprising the steps of:

(a) providing an electrosurgical probe having a cannula component with a wall having an outward surface and extending along a probe axis from a supportable proximal end to a working end region having an electrosurgically energizable cutting assembly;

(b) providing an evacuation system having an intake port located at said working end region and having a transfer channel extending along said cannula component to an evacuation outlet;

(c) interstitially positioning said electrosurgical probe working end region in an operative orientation with respect to said target tissue volume effective to carry out said procedure;

(d) energizing said cutting assembly to effect formation of a cutting arc;

(e) carrying out said procedure by maneuvering said energized cutting assembly, said arc evoking elevated temperature fluid; and

(f) removing at least a portion of said elevated temperature fluid through said evacuation system intake port and said transfer channel to an extent effective to avoid substantial thermal damage to said healthy tissue.

2. The method of claim 1 in which:

said step (f) removes said elevated temperature fluid while said steps (d) and (e) are carried out.

3. The method of claim 1 in which:

said step (b) provides said evacuation system transfer channel within said cannula component.

4. The method of claim 3 in which:

said step (b) provides said evacuation system transfer channel in thermal transfer isolation from said cannula component wall outward surface.

5. The method of claim 3 in which:

said step (f) removes at least a portion of said elevated temperature fluid through said evacuation system intake port and said transfer channel by venting said evacuation outlet to atmosphere.

6. The method of claim 3 in which:

said step (b) providing an evacuation system provides said system as comprising a vacuum pump having a vacuum port coupled in vacuum communication with said evacuation outlet, and actuable to create a vacuum condition at said evacuation outlet; and

said step (f) removes said elevated temperature fluid by actuating said vacuum pump co-extensively with said step (d) energization of said cutting assembly.

7. The method of claim 3 in which:

said step (a) provides said electrosurgical probe as further comprising an insulator sheath extending substantially over said cannula component wall and spaced an insulation distance from said wall outward surface an extent effective to define a space-based insulative tissue contacting surface exhibiting a surface temperature atraumatic to said healthy tissue.

8. The method of claim 7 in which:

said step (a) provides said cannula component as comprising an elongate rigid tube, and provides said insulator sheath as a tube extending between a forward stand-off in contact with said cannula component wall outer surface adjacent said working end region and a rearward stand off adjacent said proximal end, said forward and rearward stand-offs being dimensioned to establish said insulation distance.

9. The method of claim 8 in which:

said step (a) provides said insulator sheath as a cylindrical tube and provides said forward and rearward stand-offs by inwardly rolling the ends of said insulator sheath cylindrical tube.

10. The method of claim 8 in which:

said step (a) provides said forward and rearward stand-offs as respective forward and rearward inserts mounted intermediate said insulator sheath cylinder and said cannula component outer surface.

11. The method of claim 7 in which:

said step (a) provides said cannula component as comprising an elongate rigid tube, and provides said insulator sheath as a polymeric tube extending along a tube axis between a forward end adjacent said cannula component working end and a rearward end adjacent said proximal end and having an array of internally depending rib-form stand-offs aligned in parallel with said tube axis and extending into contact with said cannula-component outward surface, said rib-form stand-offs being radially dimensioned to establish said insulation distance.

12. The method of claim 3 in which:

said step (a) provides said electrosurgical probe cannula component as comprising an elongate tube formed with a wall thickness of thermally insulative material effective to atraumatically insulate tissue in contact with said wall outer surface from heat derived in said transfer channel from said cell derived steam.

13. The method of claim 1 in which:

said step (a) provides said electrosurgical probe electrosurgically energizable cutting assembly as further comprising at least one electrosurgically energizable precursor electrode forwardly disposed at said cannula component working end region;

said step (d) energizes said precursor electrode at the commencement of said procedure to effect formation of a precursor cutting arc;

said step (c) for interstitially positioning said electrosurgical probe is carried out while said step (d) effects said precursor electrode energization with an attendant generation of positioning elevated temperature fluid; and

said step (f) carries out removal of said positioning elevated temperature fluid while said precursor electrode is electrosurgically energized.

14. The method of claim 13 in which:

said step (a) provides said cutting assembly as comprising a tissue retrieval capture component positioned within said cannula component working end region, having a forward portion extending to a forwardly disposed cutting electrode assembly energizable to provide a said electrosurgical cutting arc at a supporting leading edge, said capture component being actuable to cause said leading edge to extend from said working end region forwardly toward a maximum peripheral extent corresponding with said target tissue volume given size and subsequently extendable while being drawn toward said probe axis to a capture orientation;

said step (d) energizes said capture component cutting electrode assembly subsequent to said step (c);

said step (e) actuates said capture component subsequent to said step (d); and

said step (f) carries out removal of said elevated temperature fluid while said capture component is actuated.

15. The method of claim 14 further comprising the steps:

(g) removing said cannula component with said capture component in said capture orientation from adjacent said healthy tissue; and

(h) continuing the said step (f) removal of said elevated temperature fluid during the carrying out of said step (g).

16. Apparatus for carrying out an electrosurgical cutting procedure interstitially at the site of a target tissue volume of given size situate in juxtaposition with healthy tissue, comprising:

a cannula assembly having an outer surface and extending along an axis from a proximal end to a forward region;

an electrosurgical cutting assembly mounted at said cannula assembly forward region, said cutting assembly supporting a cutting arc effecting the generation of elevated temperature fluid when electrosurgically energized;

an intake port at said forward region located to collect at least a portion of said elevated temperature fluid;

a transfer channel in fluid transfer relationship with said intake port and extending therefrom along said cannula assembly to an evacuation outlet through which said elevated temperature fluid is expressible; and

a support coupled with said cannula assembly.

17. The apparatus of claim 16 in which:

said transfer channel extends internally through said cannula assembly; and

said evacuation outlet is connectable with a suction source.

18. The apparatus of claim 17 in which said transfer channel is in heat transfer isolation from said cannula assembly outer surface.

19. The apparatus of claim 17 in which:

said cannula assembly comprises a cannula component configured as a tube formed of thermally insulative material.

20. The apparatus of claim 17 in which said cannula assembly comprises:

a tubular cannula component having a wall surmounting said transfer channel with an outwardly disposed component surface; and

a thermally insulative sheath extending over said cannula component outwardly disposed component surface.

21. The apparatus of claim 20 in which:

said thermally insulative sheath is formed of thermally insulative material.

22. The apparatus of claim 20 in which:

said thermally insulative sheath comprises a tube having an inner wall surface spaced a shield distance from said cannula component outwardly disposed component surface to define a thermally insulative air layer.

23. The apparatus of claim 22 in which:

said tube extends between forward and rearward ends; and

wherein said forward and rearward ends are configured as rolled ends defining respective forward and rearward stand-offs dimensioned to establish said shield distance.

24. The apparatus of claim 22 in which:

said tube extends between forward and rearward ends; and

said sheath further comprises forward and rearward stand-offs extending between said tube inner wall surface and said cannula component outwardly disposed component surface adjacent respective said forward and rearward ends, to derive said shield distance spacing.

25. The apparatus of claim 20 in which:

said thermally insulative sheath comprises a polymeric tube extending between said cannula assembly forward region and into adjacency with said proximal end and having an array of internally depending rib-form stand-offs aligned in parallel with said axis and extending into contact with said cannula component outwardly disposed component surface.

26. The apparatus of claim 25 in which:

said array of internally depending rib-form stand-offs define a corresponding array of sheath channels extending from an input port adjacent said cannula assembly proximal end to an output port at said forward region;

said input port being configured for receiving a barrier fluid under pressure for expression through said output port.

27. The apparatus of claim 26 in which:

said tubular cannula component extends along said axis to a tip and is configured having a deployment slot at said forward region extending inwardly from said tip; and

said electrosurgical cutting assembly comprises a rod-shaped electrode having a tip engaged within said slot adjacent said tip and having a retracted orientation wherein it is located within said slot and actuable in compression to deploy from said slot to define an arch-like configuration, said electrode supporting said cutting arc.

28. The apparatus of claim 16 in which:

said cannula assembly comprises a cannula component configured as a tube having a wall with an outwardly disposed component surface and an inwardly disposed passageway defining at least a portion of said transfer channel, and further comprises a thermally insulative sheath extending over said cannula component and configured as a tube having an inner wall surface spaced a shield distance from said cannula component outwardly disposed component surface to define a thermally insulative space;

said electrosurgical cutting assembly comprises a tissue retrieval capture component positioned within said cannula component at said forward region, having a forward portion extending to a forwardly disposed cutting electrode assembly energizable to provide a said cutting arc at a supporting leading edge, said capture component being actuable to cause said leading èdge to extend from said forward region forwardly toward a maximum peripheral extent corresponding with said target tissue volume given size or a portion of said size and subsequently extendable while being drawn toward said axis to a capture orientation, and

said evacuation outlet is connectable with a suction source.

29. The apparatus of claim 28 in which:

said thermally insulative sheath tube extends between forward and rearward ends; and

wherein said forward and rearward ends are configured as rolled ends defining respective forward and rearward stand-offs dimensioned to establish said shield distance.

30. The apparatus of claim 16 in which:

said cannula assembly comprises a cannula component configured as a tube having a wall surmounting said transfer channel, having an outwardly disposed component surface, extending along said axis to a tip and having a deployment slot at said forward region extending inwardly from said tip; and

said electrosurgical cutting assembly comprises a rod-shaped electrode having a tip engaged within said slot adjacent said tip and having a retracted orientation wherein it is located within said slot and actuable in compression to deploy from said slot to define an arch-like configuration, said electrode supporting said cutting arc.

31. The apparatus of claim 30 in which:

said cannula assembly further comprises a thermally insulative sheath extending over said cannula component outwardly disposed component surface.

32. The apparatus of claim 31 in which:

said thermally insulative sheath is formed of thermally insulative material.

33. The apparatus of claim 31 in which:

said thermally insulative sheath comprises a tube having an inner wall surface spaced a shield distance from said cannula component outwardly disposed component surface.

34. The apparatus of claim 33 in which:

said tube extends between forward and rearward ends; and

wherein said forward and rearward ends are configured as rolled ends defining respective forward and rearward stand-offs dimensioned to establish said shield distance.

35. The apparatus of claim 33 in which:

said tube extends between forward and rearward ends; and

said sheath further comprises forward and rearward stand-offs extending between said tube inner wall surface and said cannula component outwardly disposed component surface adjacent respective said forward and rearward ends, to derive said shield distance spacing.

36. The apparatus of claim 16 in which:

said transfer channel extends internally through said cannula assembly;

said cannula assembly forward region extends to a tip;

said electrosurgical cutting assembly comprises a generally U-shaped wire-like electrode extending in generally parallel relationship with said axis and a forward support member mounted at said forward region, having a passage

extending therethrough defining said intake port adjacent said tip and supporting said electrode to extend forwardly of said tip; and

said evacuation outlet is connectable with a suction source.

37. The apparatus of claim 36 in which said transfer channel is in heat transfer isolation from said cannula assembly outer surface.

38. The apparatus of claim 16 in which:

said transfer channel extends internally through said cannula assembly;

said cannula assembly forward region extends to a tip;

said electrosurgical cutting assembly comprises a rod-like electrode extending in generally parallel relationship with said axis, and a support member mounted at said forward region, having a passage extending therethrough defining said intake port adjacent said tip and supporting said electrode to extend forwardly of said tip; and

said evacuation outlet is connectable with a suction source.

39. The apparatus of claim 38 in which said transfer channel is in heat transfer isolation from said cannula assembly outer surface.

40. The apparatus of claim 16 in which:

said transfer channel extends internally through said cannula assembly;

said cannula forward region extends to a tip;

said electrosurgical cutting assembly comprises an electrode shaped as an open cylinder having a cylinder axis generally parallel to said axis and a forward opening defining said intake port, and a support member mounted at said forward region and supporting said electrode to extend forwardly of said tip; and

said evacuation outlet is connectable with a suction source.

41. The apparatus of claim 40 in which said transfer channel is in heat transfer isolation from said cannula assembly outer surface.

42. The apparatus of claim 16 in which:

said cannula assembly forward region extends to a tip;

further comprising at least one electrosurgically energizable precursor electrode positioned at said tip, said precursor electrode supporting a cutting arc effecting the generation of positioning elevated temperature fluid; and

said intake port is located to collect at least a portion of said positioning elevated temperature fluid.

43. The apparatus of claim 42 in which:

said transfer channel extends internally through said cannula assembly.

44. A system for carrying out an electrosurgical cutting procedure interstitially at the site of a target tissue volume of given size situate in juxtaposition with healthy tissue, comprising:

a cannula assembly having an outer surface and extending along an axis from a proximal end to a forward region;

an electrosurgical cutting assembly mounted at said cannula assembly forward region, said cutting assembly being electrosurgically energizable to form a cutting arc effecting the generation of elevated temperature fluid in the course of a said cutting procedure;

an intake port at said forward region located to collect at least a portion of said elevated temperature fluid;

a transfer channel in fluid transfer relationship with said intake port and extending within said cannula assembly to an evacuation outlet;

an electrosurgical generator actuable to effect said energization of said cutting assembly;

a suction source actuable to assert a vacuum condition at an evacuation input; and

an evacuation conduit extending in fluid transfer relationship between said evacuation input and said evacuation outlet.

45. The system of claim 44 in which:

said transfer channel is in thermal isolation from said cannula assembly outer surface.

46. The system of claim 44 in which:

said cannula assembly comprises a cannula component configured as a tube formed of thermally insulative material.

47. The system of claim 44 in which said cannula assembly comprises:

a tubular cannula component having a wall with an outwardly disposed component surface and surmounting said transfer channel; and

a thermally insulative sheath extending over said cannula component outwardly disposed component surface.

48. The system of claim 47 in which:

said thermally insulative sheath is formed of thermally insulative material.

49. The system of claim 47 in which said thermally insulative sheath comprises:

a tube having an inner wall surface spaced a shield distance from said cannula component outwardly disposed component surface and an outward surface.

50. The system of claim 47 in which:

said tube extends between forward and rearward ends; and

wherein said forward and rearward ends are configured as rolled ends defining respective forward and rearward stand-offs dimensioned to establish said shield distance.

51. The system of claim 49 in which:

said tube is formed of stainless steel; and

said cannula assembly further comprises an electrically insulative polymeric layer mounted over said tube outward surface.

52. The system of claim 49 in which:

said tube extends between forward and rearward ends; and

said sheath further comprises forward and rearward stand-offs extending between said tube inner wall surface and said cannula component outwardly disposed component surface adjacent respective said forward and rearward ends, to derive said shield distance spacing.

53. The system of claim 47 in which:

said thermally insulative sheath comprises a polymeric tube extending between said cannula assembly forward region and into adjacency with said proximal end and having an array of internally depending rib-form stand-offs aligned in parallel with said axis and extending into contact with said cannula component outwardly disposed component surface.

54. The system of claim 44 further comprising:

a support coupled with said cannula assembly adjacent said proximal end;

a manifold mounted adjacent said proximal end forwardly of said support in fluid transfer relationship with said transfer channel; and

said evacuation outlet being mounted upon and in fluid transfer relationship with said manifold.

55. The system of claim 44 in which:

said cannula assembly comprises a cannula component configured as a tube having a wall with an outwardly disposed component surface and an inwardly disposed passageway defining at least a portion of said transfer channel, and further comprises a thermally insulative sheath extending over said cannula component and configured as a tube having an inner wall surface spaced a shield distance from said cannula component outwardly disposed component surface to define a thermally insulative space; and

said electrosurgical cutting assembly comprises a tissue retrieval capture component positioned within said cannula component at said forward region, having a forward portion extending to a forwardly disposed cutting electrode assembly energizable to provide a said cutting arc at a supporting leading edge, said capture component being actuable to cause said leading edge to extend from said

forward region forwardly toward a maximum peripheral extent corresponding with said target tissue volume given size or a portion of said size and subsequently extendable while being drawn toward said axis to a capture orientation,

56 The apparatus of claim 55 in which:

said thermally insulative sheath tube extends between forward and rearward ends; and

wherein said forward and rearward ends are configured as rolled ends defining respective forward and rearward stand-offs dimensioned to establish said shield distance.

57. The apparatus of claim 44 in which:

said cannula assembly comprises a cannula component configured as a tube having a wall surmounting said transfer channel, having an outwardly disposed component surface, extending along said axis to a tip and having a deployment slot at said forward region extending inwardly from said tip; and

said electrosurgical cutting assembly comprises a rod-shaped electrode having a tip engaged within said slot adjacent said tip and having a retracted orientation wherein it is located within said slot and actuable in compression to deploy from said slot to define an arch-like configuration, said electrode supporting said cutting arc.

58. The apparatus of claim 57 in which:

said cannula assembly further comprises a thermally insulative sheath extending over said cannula component outwardly disposed component surface.

59. The apparatus of claim 58 in which:

said thermally insulative sheath is formed of thermally insulative material.

60. The apparatus of claim 58 in which:

said thermally insulative sheath comprises a tube having an inner wall surface spaced a shield distance from said cannula component outwardly disposed component surface.

61. The system of claim 60 in which:

said tube extends between forward and rearward ends; and

wherein said forward and rearward ends are configured as rolled ends defining respective forward and rearward stand-offs dimensioned to establish said shield distance.

62. The apparatus of claim 60 in which:

said tube extends between forward and rearward ends; and

said sheath further comprises forward and rearward stand-offs extending between said tube inner wall surface and said cannula component outwardly disposed component surface adjacent respective said forward and rearward ends, to derive said shield distance spacing.

63. The system of claim 44 in which:

said cannula assembly forward region extends to a tip; and

said electrosurgical cutting assembly comprises a generally U-shaped wire-like electrode extending in generally parallel relationship with said axis, and a forward support member mounted at said forward region, having a passage extending therethrough defining said intake port adjust said tip and supporting said electrode to extend forwardly of said tip.

64. The system of claim 63 in which said transfer channel is in heat transfer isolation from said cannula assembly outer surface.

65. The system of claim 44 in which:

said cannula assembly forward region extends to a tip; and

said electrosurgical cutting assembly comprises a rod-like electrode extending in generally parallel relationship with said axis, and a support member mounted at said forward region, having a passage extending therethrough defining said intake port adjacent said tip and supporting said electrode to extend forwardly of said tip.

66. The system of claim 65 in which said transfer channel is in heat transfer isolation from said cannula assembly outer surface.

67. The system of claim 44 in which:

said cannula forward region extends to a tip; and

said electrosurgical cutting assembly comprises an electrode shaped as an open cylinder having a cylinder axis generally parallel to said axis and a forward opening defining said intake port, and a support member mounted at said forward region and supporting said electrode to extend forwardly of said tip.

68. The system of claim 67 in which said transfer channel is in heat transfer isolation from said cannula assembly outer surface.

69. The system of claim 44 in which:

said cannula assembly forward region extends to a tip;

further comprising at least one precursor electrode positioned at said tip, said precursor electrode being electrosurgically energizable to form a cutting arc effecting the generation of positioning elevated temperature fluid;

said electrosurgical generator is further actuable to effect said energization of said precursor electrode; and

said intake port is located to collect at least a portion of said positioning elevated temperature fluid.